Remarks

Claims 8 - 17 are pending. Favorable reconsideration is respectfully requested.

The claims have been rejected under 35 U.S.C. § 103(a) as unpatentable over Maruyama U.S. Patent 4,617,239 ("*Maruyama*") in view of commonly assigned Tschirner et al. U.S. Patent 6,211,289 ("*Tschirner*"). Applicants respectfully traverse this rejection.

First, Applicants wish to extend their appreciation to Examiner Ojurongbe for separately discussing patentability of all the claims, both independent and dependent.

The Jepson format of claim 8 has been removed by rewriting, as the preamble, as the Examiner has indicated, might be construed as an admission. Such an admission is rebuttable, however, and in this case, Applicants believe it might be wrongly construed.

The subject invention is directed to a process for preparation of release coatings on substrates. In the past, direct application of release coatings onto substrates was largely unsuccessful. As a result, it had become common to apply a "primer" of polyvinylalcohol to the substrate, prior to applying the silicone release coating, to prevent the silicone from penetrating into the substrate, which is generally paper. However, these prior art primers also prevented satisfactory binding to the silicone release coating, and also negatively affected the ability of the silicone to crosslink, thus requiring long curing times or lengthy thermal conditioning. Both the latter either limit the line speed, thus increasing cost, or increase the total length of heating time, which is energy intensive.

Applicants solved the aforementioned problems by employing a polyvinyl alcohol copolymer binder also prepared from 1-alkylvinyl ester monomers as well as unsaturated silane monomers. The silicone release coatings not only adhered well, but exhibited rapid crosslinking as well as improved abrasion resistance. The improvement in abrasion resistance is even more marked after the primer solutions had been stored for some days.

Maruyama is directed to silane-modified polyvinyl alcohols suitable for coating paper stock for use in preparing offset printing plates and to increase paper strength. The copolymers of *Maruyama* are prepared by copolymerizing polyvinylacetate and an unsaturated silane monomer followed by hydrolysis to the polyvinyl alcohol (PVA1). However, it is well known in the art that the silane moieties in *Maruyama's* polyvinyl alcohols, are subject to hydrolytic condensation reactions:

$$\text{polymer—Si}(OCH_3)_3 \xrightarrow{H_2O}$$

$$\text{polymer—Si}(OCH_3)_2 \text{—O—Si}(OCH_3)_2\text{— polymer} + 2CH_3OH.$$

This initial chain-extending reaction may be followed, due to the presence of still-unreacted alkoxy groups, by branching and crosslinking. Furthermore, the silyl methoxy groups are reactive with the hydroxyl groups of PVA1. All these increase the viscosity of the polymers greatly, and thus incorporation of such silane groups into polyvinyl alcohols is known to decrease storage stability, manifested by a marked increase in viscosity. Moreover, this is not a physical phenomenon which is reversible, but a chemical phenomenon forming more favorable chemical bonds, and essentially irreversible. *Maruyama* was first published in 1983 (Japan), and issued as the U.S. Patent in 1986. The Japanese publication was *ca.* 20 years before the present invention.

Tschirner is not directed to polyvinylalcohols, but rather is directed to specially modified polyvinyl <u>acetals</u>. These polyvinyl acetals are prepared by acetalizing (for example with butyraldehyde) a polyvinyl alcohol copolymer derived from vinylacetate and 1-alkylvinyl acetate. Following hydrolysis of the latter, reaction with the aldehyde takes place under acid catalysis. The polyvinyl acetals are useful as binders for printing inks.

One problem with the preparation of low molecular weight polyvinyl acetals is that the corresponding low molecular weight polyvinyl alcohol starting materials tend to gel in aqueous solution, in a manner similar to gelatin. This is not a result of chemical reaction, but

rather one of association and hydrogen bonding of polar groups (polyvinyl alcohols have one polar, hydrogen bondable OH group per vinyl group, thus, many of these groups). This association is reversible, and just as does gelatin, such products liquify at higher temperatures, *e.g.*. 50°C. *See Tschirner* at column 1, lines 52 - 58. This room temperature gellation of PVA1 was improved by incorporating a 1-alkylvinyl acetate moiety into the PVA1, followed by acetalization. As is the case with gelatin, gellation is only a problem at high concentration.

However, *Tschirner* is not directed to use of PVA1 as a primer, nor for any purpose whatsoever except as a precursor to polyvinyl acetals. *Tschirner* surprisingly discovered that the viscosity of polyvinyl <u>acetals</u> formed from the 1-alkyl vinyl acetate-modified PVA1's was independent of the vinyl alcohol content over a wide range, and that the resulting polyvinyl acetals, at the same molecular weight as acetals formed from homopolymeric PVA1, had a lower solution viscosity.

Thus, the only teaching one skilled in the art would glean from *Tschirner* is that in preparing polyvinyl acetals where low viscosity is desired, one should start with 1-alkylvinyl acetate-modified PVA1s rather than PVA1 homopolymers. *Tschirner* was first published in 1998, some 5 years prior to Applicants' invention.

The problems addressed by the subject invention and those addressed by *Maruyama* and *Tschirner* are completely different. *Maruyama* wished to minimize penetration of PVA1 into paper by supplying a reactive PVA1 which reacts not only with cellulosic hydroxyl groups, but also with hydroxyl groups of PVA1 itself. *See Maruyama* at column 9, lines 8- 25. Thus, the polymer gels rapidly at the paper interface (containing huge numbers of hydroxyl groups), preventing its migration into the paper. This reaction of hydrolyzable silyl groups with PVA1 hydroxy groups is also responsible for the aqueous instability noted earlier, which all skilled in the art are aware of, and to which reaction *Maruyama* himself attests.

Tschirner, on the other hand, is only marginally interested in PVA1s at all - only as a starting material for polyvinyl acetals. For this purpose, he notes that avoiding room

temperature gellation is desirable (but certainly not necessary, as he very easily made polyvinyl acetals from conventional PVA1s as well (see all his comparative examples)). However, if *Tschirner's* discussion of avoiding polyvinyl alcohol gellation is the only isolated teaching derived from him, it is clear that <u>any modification of PVA1 copolymers which would be expected to generate viscosity increases would be directly against his teaching</u>.

However, *Maruyama* indicates that his reactive silane groups react with the PVA1 OH groups (it has been known for many years that such silane groups react with each other - the basis for moisture curable silicone caulks and sealants), and thus one skilled in the art would not be motivated to add a silyl group of *Maruyama* to a PVA1 of *Tschirner*, since the expected result would be an unstable polymer which exhibits considerable viscosity increase in aqueous solution, and would gel at even lesser concentrations than *Tschirner's* PVA1 or conventional homopolymeric PVA1.

Thus, not only would one skilled in the art <u>not</u> be motivated to add hydrolyzable silane groups to *Tschirner's* PVA1, but moreover, the result is not the expected result, contrary to the holding in *KSR*, for example. Here, as shown by the examples and comparative examples, the silane-modified inventive PVA1's of the subject invention showed virtually <u>no</u> viscosity increase upon storage. The viscosity only increased from 28.1 mPa·s to 28.3 mPa·s over two weeks. This is an increase of only 0.7%, and being so small, is even hard to measure and differentiate accurately! Yet the very similar *Maruyama* silane-modified homo-PVA1 showed a viscosity increase of 260%, an increase of a factor of 370 (260 ÷ 0.7)! One skilled in the art would expect that a silane-modified 1-alkylvinyl/vinyl alcohol copolymer would show a similar increase in viscosity, due to the fact that both contain the same reactive silane group, and a huge number of PVA1 hydroxyl groups as well. However, surprisingly that was not the case.

Moreover, the acetalization of PVA1 to polyvinyl acetals, for reasons of economy (smaller storage tanks, reactors, pumps, etc.) employs concentrated PVA1 solutions. Note in *Tschirner's* examples, that PVA1 was supplied as a 20% solution. Primer coatings do not employ such concentrated solutions. For example, the viscosity measurements reproduced in the

tables used a concentration of PVA1 which is only about half (11%) than that employed by *Tschirner*. At this lower PVA1 content, gellation is not a problem. For example, if the directions on a package of gelatin (e.g. JELLO™) are not followed, and twice as much water is added, no gel will be formed - only a liquid.

It is also noted that *Maruyama* (*See* column 9) discloses that it is necessary that his product gel at the surface of the substrate to prevent penetration. Contrary to this, the teaching relied upon from *Tschirner* is to provide PVA1s which do not gel. These objectives are diametrically opposed, and therefore uncombinable. One would not modify a *Maruyama* silane-modified PVA1 in a manner so as to prevent gelling which *Maruyama* desires.

However, in addition, the present inventor's have achieved surprising and unexpected results. After seven days of storage, the silicone release coat applied over the primer coat showed a much higher scratch resistance than either the silane-modified PVA1 of *Maruyama* or a conventional PVA1. This result is neither taught nor suggested by *Maruyama*, *Tschirner*, or their combination.[1]

The difference in scratch resistance is striking, and cannot be due to viscosity effects alone, since at seven days, the ratio of silane-modified PVA1 viscosity to subject invention PVA1 viscosity is only about 2:1 (61.7 mPa·s v. 28.2 mPa·s). Both these are relatively low viscosity, about that of the vegetable oils (raw linseed oil, *ca.* 28 mPa·s; corn oil, *ca.* 72 mPa·s). If anything, the more viscous silane-modified PVA1 of *Maruyama* would be expected to exhibit <u>less</u> penetration into the substrate (which was *Maruyama's* objective) and thus be <u>more</u> efficient as a primer. Instead, the results show that Applicants' <u>less viscous</u> primer is superior. Why is this? Why should it be so? This result is certainly surprising and unexpected. Withdrawal of the rejection of the claims on this basis is further solicited.

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[1]The increased scratch resistance is not recited in the claims, but it need not be, when the feature responsible therefore (the use of Applicants' primer) is recited. *See, e.g. In re Merchant*, 197 USPQ 785 (CCPA 1978).

Providing a primer which allows both good adhesion to silicone release coatings as well as allowing rapid cure of the release coatings is a long-felt need, as attested to be the first few pages of the specification. The invention of *Maruyama* had been known to the public for some 20 years prior to Applicants' invention. *Tschirner* was known to the public some five years prior to the present invention. Despite this knowledge, prior to Applicants, no one had attempted to produce a primer of Applicants based on these teachings. The existence of a long felt need and a solution which occurred only many years after the cited references were published is an important secondary consideration which must be considered in assessing patentability. *See, e.g. In re Sernaker*, 217 USPQ 1 (Fed. Cir. 1983).

For the foregoing reasons, it is respectfully submitted that one skilled in the art would not be motivated to combine *Maruyama* and *Tschirner*; that the references themselves have opposing goals with respect to gellation; that unexpected and surprising results have been achieved, not an expected result; and that Applicants' invention has resolved a long felt need many years after the references' publications. Withdrawal of the rejection for all these reasons is respectfully solicited.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, the Examiner is highly encouraged to telephone Applicants' attorney at the number given below.

Please charge any fees or credit any overpayments as a result of the filing of this paper to our Deposit Account No. 02-3978.

Respectfully submitted,

Andreas Bacher et al.

By

William G. Conger
Reg. No. 31,209
Attorney/Agent for Applicant

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BROOKS KUSHMAN P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075-1238
Phone: 248-358-4400; Fax: 248-358-3351